(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

**UNIVERSITRY EXAMINATIONS
2019/2020 ACADEMIC YEAR**

FOURTH YEAR FIRST SEMESTER EXAMINATIONS

**FOR THE DEGREE
OF
BACHELOR OF SCIENCE
IN CIVIL AND STRUCTURAL ENGINEERING**

COURSE CODE: CSE 431

COURSE TITLE: ENVIRONMENTAL ENGINEERING

DATE: Wednesday 15ᵗʰ January 2020 TIME: 12.00 – 2.00 pm

INSTRUCTIONS:
1. This Paper Consists of FIVE Questions
2. Attempt any FOUR Questions
3. It is to the best interest of the candidate to write legible
4. Examination duration is **2 Hours**

MMUST observes ZERO tolerance to examination cheating
This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE

a) Outline the significance of the following parameters in environmental engineering
[4 marks]

    i)   Phosphorus ii) pH iii) Fluoride iv) Ammonia

b) Given the following data:

-Weight of a dish = 48.6212 g,

-100mL of sample is placed in the dish and evaporated. New weight of dish and dry solids = 48.6432 g.

- The dish is placed in a 550°C furnace, then cooled. New weight = 48.6300 g.

Find the total, volatile, and fixed solids   [6 marks]

c) Distinguish between environmental impact assessment [EIA] and environmental Audit
    (EA)   [2 marks]

d) The Government of Kenya received funding from African development Bank for construction of a multipurpose dam along River Nzoia, upstream of Webuye town. Outline any FOUR possible impacts to be considered when carrying out an EIA study
[8 marks]

QUESTION TWO

a) Outline the limitations of COD test   [4 marks]

b) The BOD and COD of wastewater samples are given in the table below

Sample	BOD_5 (mg/l)	COD (mg/l)
A	350	780
B	520	750
C	200	690

i) Why are the BOD and COD values of same waste different?   [3 marks]

ii) What inferences can be drawn about the biodegradability of the above wastes?
[3 marks]

c) You have been contracted by UNHCR to design a suitable sanitation system in a new established refugee camp. Advice on the possible conservancy system(s) that can be constructed for the refugee community   [4 marks]

d) Explain any two economic instruments that can used to enforce sustainable development in Kenya   [6 marks]

QUESTION THREE

a) The monitoring exercise for removal of fluoride in a treatment plant yielded the results in the table below. Confirm that the fluoride removal follows first order kinetics and determine the reaction rate constant   [10 marks]

Time (days)	0	1	2	3	4	5	6	7	8	9	10
Fluoride Concentration(mg/l)	80	62	45	35	27	20	16	13	9	7	4

b) Explain adsorption process and its importance in environmental engineering
[6 marks]

c) Explain why *Escherichia coli* is used as an indicator of faecal contamination?
[4 marks]

QUESTION FOUR

a) The BOD$_5$ of a wastewater is determined to be 120mg/l at 20^{0}C. The reaction constant, k (base 10) is 0.12 d^{-1}. What would be the BOD$_{10}$ if the test had been conducted at 15°C?
[6 marks]

b) What are the factors influencing the settling of particles in a sedimentation basin?
[4 marks]

c) Explain the significance of algae protozoa and viruses in sanitary engineering
[6 marks]

d) Why is water carriage sanitation preferred to conservancy system?   [4 marks]

QUESTION FIVE

a) Wastewater mixes with a river resulting in a

BOD = 10.9 mg/L and DO = 7.6 mg/L

The mixture has a temperature = 20 °C

Re-aeration constant = 0.41 day^{-1}

De-oxygenation constant= 0.2 day^{-1}

Average flow velocity = 0.3 m/s,

DO saturated = 9.1 mg/L

i) Find the time and distance downstream at which the oxygen deficit is a maximum
[6 marks]

ii) Find the minimum value of DO   [4 marks]

b) Developing countries such as Kenya experience serious environmental degradation than their affluent counterparts. Justify this statement   [6 marks]

c) Explain the following principles of sustainable development

(i) Inter-generation equity ii) intra-generation equity   [4 marks]

--END--

Some useful formulae

$$D_t = \frac{k_d L_o}{k_r - k_d}\left(e^{-k_d t} - e^{-k_r t}\right) + D\left(e^{-k_r t}\right)$$

$$t_c = \frac{1}{k_r - k_d} \ln\left[\frac{k_r}{k_d}\left(1 - D\frac{k_r - k_d}{k_d L_a}\right)\right]$$

$$D_c = \frac{k_d L_o}{k_r - k_a}\left(e^{-k_d t_c} - e^{-k_r t_c}\right) + D e^{-k_r t_c}$$

431: ENVIRONMENTAL ENGINEERING